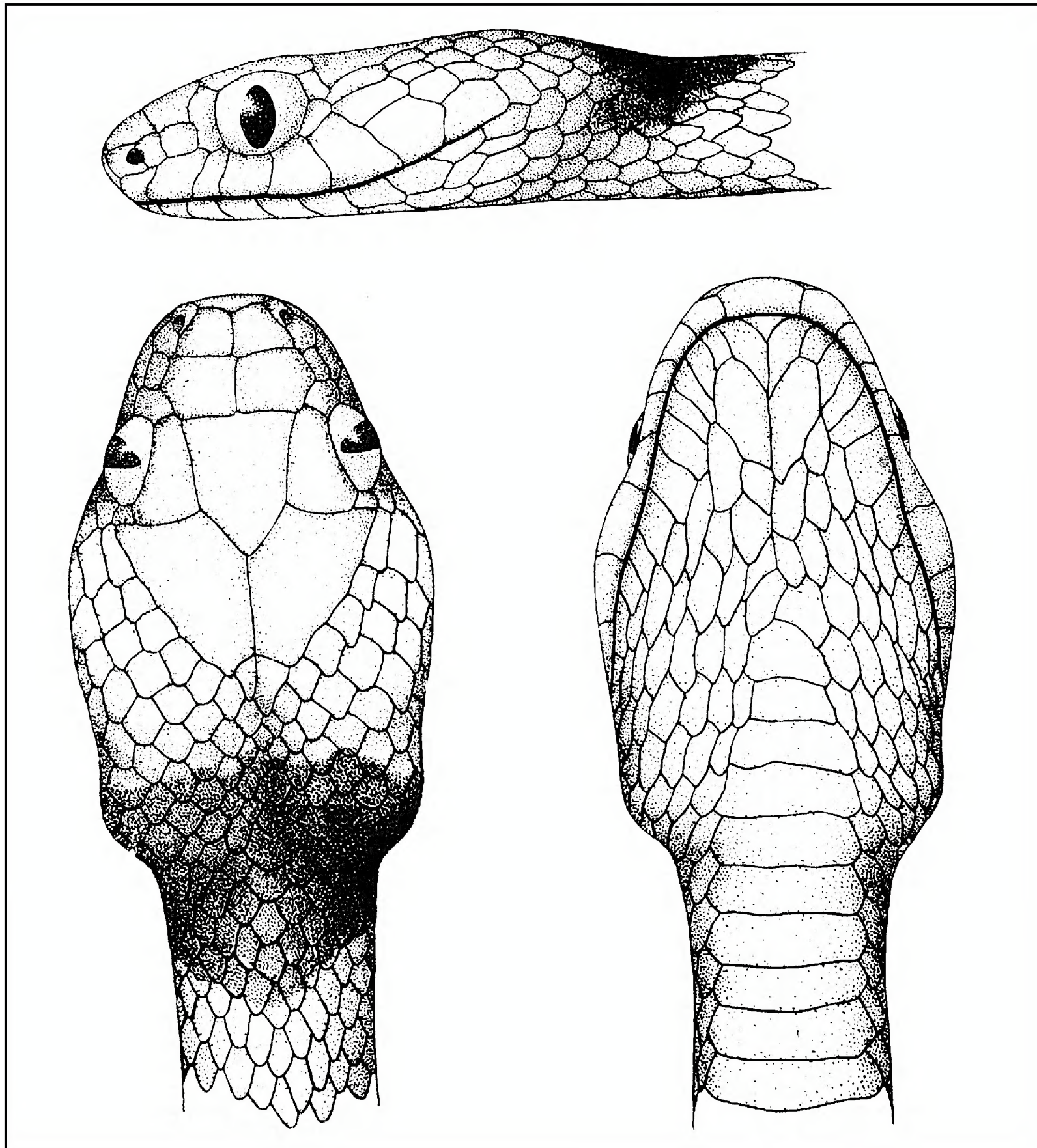

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The Enigma of the North Margin of the Amazon River: Proven *Lachesis* Bites in Brazil, Report of Two Cases, General Considerations about the Genus and Bibliographic Review

Rodrigo C. G. de Souza¹, Ana Paula Bhering Nogueira², Tiago Lima³ and João Luiz C. Cardoso⁴

Abstract

Confirmed snakebite accidents involving *Lachesis* vipers (bushmasters, or *surucucu*) are rare in the literature. We present two cases that occurred recently in the southern region of Bahia State, Brazil. These two cases were singled out of a series of nine accidents. Both presented intense local pain, edema, mild local ecchymosis, local hemorrhage and dramatic systemic alterations within the first 30 minutes after the bite: hypotension, vomiting and diarrhea, sinus bradycardia configuring a pre-shock state. Both patients were treated with antivenom within 60 minutes of the accident: one received 20 I.V. vials of Bothropic-Lachetic Antivenom (BLA — Butantan Institute) and the other received 10 I.V. vials of BLA. Both patients recovered fully. Few laboratory tests were made and both snakes were positively identified. Accidents in the north margin of the Amazon River seem to present different signs and symptoms. The objective of this case report is to contribute to a better understanding of these envenomings and of the genus as a whole, aiming at early diagnosis and treatment of *Lachesis* snakebites.

Keywords: *Lachesis*, bushmaster, snakebite, case report, poisoning.

Introduction

Proven *Lachesis*-inflicted accidents are rare in scientific literature while, on the other hand, the genus is given almost mythological status by common folk. According to the Villas-Boas brothers (indigenists and field men, who dedicated most of their lives to making first contact, in the late '40s, with previously unknown Indian tribes in the Amazon where the "white man" had never set foot before), "[*Lachesis*] is the only venomous snake of Brazil that might actually attack a human being" (Villas Boas and Villas Boas, 1994). In the ancient Tupi-Guarani Indian language, *surucucu* stands for "one who strikes repeatedly" (Silveira Bueno, 1982). Exploratory expeditions to South America such as those carried on by Von Spix and Von Martius (1817-1820) brought back to Europe weird, exaggerated accounts of huge snakes attacking campfires, for instance that by John Manley (1851), shown in Figure 1.

Those who actually deal with *Lachesis* on a daily basis, find it of "calm disposition and delicate constitution" (Boyer et al., 1989). However, when cornered, wounded, thermally disoriented or guarding eggs, the genus may react in a very particular way. In the words of the experienced Rob Carmichael (pers. com.):

As far as safety goes, I never work with these snakes unless I am 100% focused and alert. I keep many elapids (including king cobras), *Bothrops*, crotalines, etc. but nothing strikes more concern in me than these bushmasters. I fully know that a bite could end my life, which is why when I work with the bushmasters, I don't work with any other snake that day. . . . I want to make sure that I am ready, focused, relaxed and ready for anything. So far, I have found the bushmasters to be amazingly calm and wonderful ani-

mals; however, I also have experienced first hand the full wrath of this species. . . . Even a 16' king cobra coming full steam at me didn't scare me as much as an 8' bushmaster in full "I want to kill you" mode did a year ago. It made me completely rethink my strategies and safety procedures when working with them. But, for the most part, they have been very easygoing and I think staying calm, deliberate, keeping movements slow and always working on the bushmaster's terms is the best course of action.

This dauntless behavior, its almost mythical status and even

Snake's Antipathy to Fire. — There is in Brazil a very common poisonous snake, the Surucucu (*Trigonocephalus rhombatus*), respecting which the Matutos and Sertanejos, the inhabitants of the interior, relate the following facts. They say that such is the antipathy of this reptile to fire, that when fires are made in the clearing away of woods, they rush into it, scattering it with their tails till it is extinguished, even becoming half roasted in the attempt; and that when an individual is passing at night with a torch, they pass and repass him, lashing him with their tails till he drop it, and the snake is immediately found closely coiled round the extinguished torch. The greatest enemy of this snake is an immense Lacertian, five and six feet long, the Tiju-açu (the great lizard—its name in the Língua geral): it is said that when the snake succeeds in effecting a bite, the lizard rushes into the wood, eats some herb, and returns to the conflict, which almost invariably terminates in its favour.
JOHN MANLEY.
Pernambuco, June 30. 1851.

Figure 1. Note published in London in 1851 reporting the alleged "Antipathy to fire" of *Lachesis*.

1. Itacaré Medical Foundation, Itacaré, Bahia State, Brazil.
2. Physician, Municipality of Itacaré, Bahia State, Brazil.
3. Biologist, Belo Horizonte, Minas Gerais State, Brazil.
4. Corresponding author: Hospital Vital Brazil—Butantan Institute, Av. Vital Brazil 1500, 05503.900, São Paulo / SP, Brazil. jlcardoso@butantan.gov.br

religious associations with “the evil one” fuel the ongoing slaughter of the species. In the case of the Atlantic bushmaster (*Lachesis muta rhombeata*), the destruction of 93% of its natural habitat makes it a highly endangered species, classified as “Vulnerable” by the International Union for the Conservation of Nature.

Case Reports

In six years in the region of Ilhéus, Bahia State, Brazil, we have positively identified eight accidents as caused by *Lachesis*, the most recent on 21 January 2007 and 28 February 2007. A ninth accident took place just before our arrival in the region and resulted in the almost instant death of J.A.D., a 7-year-old boy, who went out of his impoverished house at night to pee, stepped on an animal and was bitten more than once according to the family.

If there is venom inoculation, the first 60 minutes of these accidents are always dramatic and similar to the evolution of hypovolemic shock: severe hypotension may occur within 20 minutes, along with hypothermia as low as 35°C, vomiting, diarrhea, abdominal pain, difficulty swallowing, sensorial disorientation, sinus bradycardia, and eventually shock and cardiac arrest. Although these signs and symptoms are the norm in our experience, a literature review revealed no general agreement about them. This can be explained at least in part by the difficulty in determining what genus actually caused the accident (Hardy and Silva Haad, 1998), especially in the Amazon area where large *Bothrops atrox* (Linnaeus, 1758) are commonly confused with (small) *Lachesis* specimens. Of the eight above-mentioned cases, we chose to report only two, in which the animals are still alive, positively identified and photographed.

Case 1:

T.L., professional herpetologist and biologist, male, 23 years old, healthy, 140 pounds, was bitten on the top of his head by a 2.0 m male *Lachesis* at 11:40 on 27 May 2005 while working with de Souza in the Serra Grande Center:

Sequence of events from 27 May 2005, 11:40 A.M. on:

Time snce bite (hrs:mins)	Signs and symptoms	Medication
00:05	Severe local pain.	
00:10	Pain in the entire face, throat and neck.	
00:15	Profuse sweating; upper abdominal pain; vomiting.	

00:20	Hypotension; weak pulse; sinus bradycardia; pale; profuse sweating; pre-shock. Drowsy; vision, hearing and speech alterations; hypersalivation; great difficulty swallowing.	In the car, en route to hospital, began infusion of saline solution, atropine, metoclopramide and dopamine.
		
	Figure 2a.	
00:40	Not rousable, carried to the ICU of Regional Hospital, Ilhéus, Bahia. Watery diarrhea. Blood pressure upon admission at 60 × 40 mm Hg.	Infusion of 1000 ml of saline solution up to this point.
00:45	Preparation for antivenom therapy. See Observation 1 below.	Promethazine, hydrocortisone.
00:55		12 I.V. vials of Bothropic-Lachetic Antivenom diluted in SGI 5% + another 500 ml of saline solution 0.9%.
01:00	Intense pain. Coagulation time > 30 min.	Meperidine 40 mg I.M. Check Observation 2 below.
02:00	End of antivenom infusion. Drowsy. Profuse bleeding at the wound site.	
		
	Figure 2b.	
02:06	Blood pressure at 100 × 60 mm Hg.	Fifth 500 ml of saline solution.
02:10	Local pain even with meperidine. Profuse bleeding at the inoculation site. Pain in knee joints.	

02:20	Vagomimetic symptoms still present. Recovering consciousness.	
02:27	Intense diffuse head pain. Diarrhea, drowsiness, vomiting.	
03:12	Profuse local bleeding persists.	
03:25	Blood pressure at 90 × 40 mm Hg.	
03:36	Protection of gastric mucosa against bleeding (vomiting, stress).	Omeprazol
04:11	Blood pressure at 90 × 60 mm Hg	Sixth 500 ml saline solution I.V. infusion.
04:22	Urinary debt at zero ml.	
04:24	Coagulation of bleeding at the wound site. 	
	Figure 2c. (scale in cm)	
04:25	Urinary debt + (sui generis)	
12:20	Stable.	
00:00 / 28 May 2005		
14:55	Blood pressure at 80 × 40 mm Hg.	
15:20	Blood pressure at 90 × 50 mm Hg.	
18:20	Blood pressure at 60 × 30 mm Hg.	Additional 8 I.V. vials of Bothropic-Lachetic Anti-venom (Butantan)
20:40	Normal renal function biochemistry.	

29:20	Edema extending from left eye to back portion of head and neck. 	
	Figure 2d.	
31:20	Hemodynamically stable all day long; normal macroscopic aspect of urine. No bleeding at wound site. Mild local ecchymosis on face and right arm.	
31:25	Gastrointestinal bleeding (melaena) without hemodynamic repercussion.	
36:20	Stable; vital signs within normal parameters.	
00:00 / 29 May 2005		
48:20	Hemodynamically stable with normal kidney function biochemistry.	
Hospital discharge		

Observations:

1. "Preparation for antivenom therapy" according to *Handbook for Diagnosis and Treatment of Accidents with Poisonous Animals* [1998. Brasília: Health Ministry, National Health Foundation]. It should be stressed however, that Bucarechi et al. (2002) have demonstrated that this routine is not only inefficient but potentially harmful.
2. The use of meperidine may aggravate the vagomimetic symptomatology and cause respiratory depression, requiring extra care if it is used for pain control.
3. Vomiting did not become a major problem/symptom due to early administration of metoclopramide, 10 minutes after the bite.

Late biochemistry (4–7 days after the accident, performed in Belo Horizonte, Minas Gerais State) indicated consumption of coagulation factors on the occasion of the accident and a slow recovery in the following days.

Ambulatory Follow-up for 21 days (D1–D21)

D4 (1 June)	Blood urea 43 mg/dl; serum creatinine 1.0 mg/dl Total CK: 65 units/l C-reactive protein: 2.6 mg/dl Prothrombin time (quick): 18.6 seconds Prothrombin activity: 56%
D6 (3 June)	Platelet count: 251,000 / mm ³ Prothrombin time: 15.4 seconds Prothrombin activity: 71%
D15–D21	“Serum disease”: fever, dermatitis, painful knee/elbow joints, jaundice ++ /4+ Stomach ache Fully recovered at D30

This is the only available blood chemistry. During this patient’s treatment, only coagulation time (CT) tests were performed (> 30 min, always). Most Brazilian hospitals of the public health system (SUS) are poor and lack just about everything. However, whenever possible, one should rely on exams such as a complete hemogram (neutrophil leukocytosis, hematocrit may rise in the early stages due to hemoconcentration because of increased permeability of capillaries). Later on, the hematocrit falls due to bleeding in the interstitial space. Other essential exams are: INR, prothrombin time, FDP, renal function and continuous cardiac monitoring as well. As to late symptoms, articular pain was the most noticeable, along with great difficulty swallowing solid food due to gastritis.

Case 2:

Patient J.A.S., male, 49 years old, professional herp keeper at CEPLAC, a federal agency for cocoa research, was bitten in the medial third of the left forearm on 2 October 2006 at 8:30 A.M. by a two-meter male *Lachesis* fed 15 days before. Upon clinical examination, only one inoculation point was found.

J.A.S. suffers from high blood pressure and is under regular medication, but on that specific morning he reports to have forgotten to take his 25 mg of Captopril — this might have saved his life.

The first symptom was severe pain, and the patient immediately drove his car for 20 minutes to a nearby hospital, where he arrived “at the limit of his strength.” Upon admission, systolic blood pressure was 70 mm Hg with no detectable diastolic blood pressure. The patient also presented intense sweating, diarrhea, upper abdominal pain and great difficulty swallowing.

Infusions of saline solution 0.9% + metoclopramide + 10 I.V. vials of Bothropic-Lachetic Antivenom (BLA — Butantan) were simultaneously administered. Coagulation time could not be measured (over 30 minutes) and remained like that for the next 24 hours, during which he had a compressive bandage around the wound site. The patient developed a moderate systemic reaction to the antivenom (see Figure 3). After 24 hours of hospitalization, blood pressure stabilized, bleeding at the inoculation point stopped, urinary debt was over 40 ml/hour

with normal macroscopic aspect. Therefore, after another two days under observation, he was discharged for an ambulatory follow-up. The left arm remained sore for two weeks.



Figure 3. J.A.S. back to work 14 days after the accident, handling the same animal involved in the accident.

Discussion

All confirmed accidents by *Lachesis* should be considered life-threatening since even mere scratches, one fang inoculations and accidents with babies or youngsters (Ripa, 2002), characterized by small amounts of poison delivered may still provoke early systemic symptoms, something we do not observe in the sympatric *Bothrops* genus, where the size of the animal is the most important prognostic factor: bigger animal = more venom = more damage (Ribeiro and Jorge, 1989). By saying this, we do not intend to affirm that the amount of venom delivered is unimportant for the clinical evolution, since in vitro, the neurotoxic action of the venom is dose-dependant. On the other hand, based on our experience, we infer the existence of a “Minimum Activating Dose” (M.A.D.) which triggers all symptomatology. It is worth noticing that this “M.A.D.” is way below the 400 mg potentially delivered by adult bushmasters.

Regarding the biochemistry of *Lachesis* venom, the following activities have been described:

- Plasminogen activation, which increases the permeability of blood vessels, promoting edema and indirectly helping to lower blood pressure since large amounts of plasma may be lost from the vascular compartment (Sánchez et al., 2000; Hermogenes et al., 2006).
- Coagulant activity, where toxins such as the so-called “thrombin-like” enzymes act upon the fibrinogen, forming small clots that will be deposited in organs like kidneys and lungs, and eventually obstruct capillary blood flow (Magalhães and Diniz, 1979; Magalhães et al., 1973, 1981, 1997, 2003).

- Hemorrhagic activity, caused by metalloproteinases commonly called hemorrhagins, which directly damage capillary walls. The hemorrhagic and coagulant activities overlap each other and will trigger local and systemic hemorrhagic disorders (Rucavado et al., 1999; Estêvão-Costa, Diniz et al., 2000; Estêvão-Costa, Martins et al., 2000; Sánchez et al., 2003).
- Inflammatory action, mostly due to thrombin-like serine proteinases, phospholipase A₂ (PLA₂), metalloproteinases, histamine, serotonin, nitric oxide, by-products of the metabolism of the arachidonic acid, leukocyte recruitment and release of cytokines, and lymphoedema. Activities (A) and (C) are also important actors in this process. We believe that the immune system also plays a major part here, bringing to the wound site activated macrophages, oxygen radicals, gamma interferon, tumor necrosis factor among other “big guns” (Silva et al., 1985; Warrell, 1989; Soares et al., 2005).
- Proteolytic activity, due to direct action of proteases (thrombins in particular), metalloproteinases, important myotoxic and cytolytic venom factors. Necrosis may be aggravated by ischemia due to thromboembolic alterations, by possible tourniquet use or by compartment syndrome (unlikely in *Lachesis* bites). Proteolytic action is seldom seen if specific antivenom is administered within the third hour of the accident (Otero et al., 1998).
- Myotoxic action, due to the action of PLA₂s among other enzymes, generating an inflammatory infiltrate composed of polymorphonuclear leukocytes and macrophages, found around necrotic cells and in the interstitial space. Inexperienced surgeons may easily confuse the deposition of hemorrhagic debris over the muscle with direct myotoxic effects on the muscles (necrosis) but, given the chance to act due to delayed treatment or insufficient neutralization, the PLA₂s will induce necrosis of skeletal muscle fibers (Otero et al., 1998; Fuly et al., 2000; Damico et al., 2005).
- Defibrinating activity, resulting in incoagulability, a consumption coagulopathy (of factors II, VIII, IX and X, with normal platelet counts) that also occurs because of the direct action of thrombin on fibrinogen, and because several proteins with enzymatic activity such as PLA₂ and proteinases inhibit blood clotting (Yarlequé et al., 1989; Otero et al., 1998; Estêvão-Costa et al., 2000).
- Indirect hemolytic activity, thus called (indirect) because lectins mediate the process. Direct hemolysis is observed in some bee and elapid envenomings, with direct destruction of the cell wall (Otero et al., 1998; Silva Haad, 1982).
- “Kininogen-like” action, auto-pharmacological in nature since the venom will make the body release substances like bradykinin and kallikrein that will induce hypotension (Diniz and Oliveira, 1992; Giovanni-De-Simone et al., 1997; Felicori et al., 2003, 2005; Weinberg et al., 2004).
- Action of bradykinin-potentiating peptides that interfere with the metabolism of bradykinin, making it last longer in the blood, contributing to a longer lasting hypotension (Soares et al., 2005).
- Neurotoxic action, recently described and based on the

isolation of the basic PLA₂, since its purified form from *Lachesis* venom called LmTX-1 induced an irreversible block in neuromuscular transmission in vitro, in concentrations as low as 1 mg/ml (Damico et al., 2005, 2006)

We believe that the so-called “activation of the parasympathetic autonomous nervous system” can be considered partly neurotoxic in nature, with kinins (Silva Haad, 1982) and phospholipases playing a major role. Therefore, in *Lachesis*, the abnormally quick shock onset seems best explained by a synergy hypothesis, in which neurotoxicity, vasodilatation and leaks to interstitial space independently play a part.

One can only speculate as to the causative factors of specific clinical alterations such as dysphagia or the “vagal triad” (hypotension, diarrhea, vomiting — and why not, a fourth element: sinus bradycardia) or sensorial disorders (to colors, deafness, uncoordinated march) that will take place within 30–45 minutes after a bushmaster bite in Brazil, BUT it is not speculation to affirm that these clinical features can be considered pathognomonic of the genus that caused the accident, as noted by Jorge et al. (1997):

A review of reports of 20 cases of bites in humans reliably attributed to this snake [*Lachesis*] in Costa Rica, French Guyana, Brazil, Colombia and Venezuela confirms a syndrome of nausea, vomiting, abdominal colic, diarrhea, sweating, hypotension, bradycardia and shock, possibly auto-pharmacological or autonomic in origin, not seen in victims of other American crotaline snakes.

Bothropic accidents may lead to shock and hypotension and even death within one hour of inoculation, but such events are rare (Cardoso et al., 2003; Silva Haad, 1982). Statistics of a major ER (H.P.S João XXIII) in Belo Horizonte, Brazil, show that only 5% of all bothropic accidents present hemodynamic alterations such as blood pressure drops upon admission (Cecilia Haddad, pers. com.). A series of 29 accidents involving *Bothrops jararacussu* (Lacerda, 1884), normally the worst bothropic accident, presented two (6.8%) hemodynamically unstable patients (Milani et al., 1997). Therefore, hemodynamic repercussion as well as all morbidity in the bothropic accident is dose-dependent. It isn’t so in *Lachesis*, probably due to the combination of factors described above. As long as at least the “M.A.D.” is inoculated, the synergy of effects will produce major blood pressure drops in humans with unsurpassed speed.

Our observations about how dangerous these intoxications may be in humans are in agreement with recent accidents with North American herpetologists and also with a series presented by Bolaños et al. (1982) where three of four patients died, even with early (but insufficient) antivenom therapy (Ripa, 2002; Bolaños et al., 1982). Adult *Lachesis* may reach or exceed 3.40 m TL (Ditmars, 1933; Campbell and Lamar, 2004) and according to Bolaños (1972), can inoculate 333 mg or more of venom, but although there are usually great amounts of toxins to be neutralized, the severity of the symptoms is not necessarily related to the amount of venom injected. The unique, dose-independent body response to the overwhelming synergy, which includes direct actions of the poison, auto-pharmacological events and individual characteristics, something also noted by another author-victim (Ripa, 2002), can be taken as a stand-

point for further studies on the fundamentals of the “M.A.D.” concept.

The present work diverges from that presented by Bührnheim, Souza and others (Sá Neto, 1995; Souza and Bührnheim, 1999), in which they report that only 15% of *Lachesis* accidents in the Manaus area (Amazonas State) present the “vagal triad” as a clinical feature. Their statistic may be due to: (1) inclusion of dry bites in their series (“only about 50% of people bitten by venomous snakes are actually envenomed” [Warrell, 1989]); (2) wrong information from patients (common) as to which animal caused the accident; (3) wrong classification by M.D.s (common) of the snake brought to the hospital; (4) mistakes in the application/interpretation of ELISA tests. Or maybe the clinical practice of the M.D.s working on the north margin of the Amazon river is revealing a totally different pattern of venom action when compared to the Atlantic coast and north of Mato Grosso State envenomings. Therein lies the enigma of the “north margin.”

Only accidents by *Lachesis acrochorda* (Garcia, 1896) in Colombia should present low or no “vagal symptomatology” (Warrell, 2004), but Silva Haad (1982) and Hardy and Silva Haad (1998) presented three cases from Colombia in which the “triad” was observed. It has been experimentally proven that samples of venom from Brazil, Costa Rica, and Colombia did display toxic and enzymatic differences (Hardy and Silva Haad, 1998; Otero et al., 1998), but all induced a qualitatively similar pathophysiological profile in vitro (Otero et al., 1998). We will comment further down (see map below) on clinical variations in *Lachesis* accidents in humans as described by Warrell (2004), keeping Silva Haad and Hardy in mind: that “we are not mice.” Maybe the observations (85% absence of “vagal symptoms”) of our colleagues of the “north margin” will also fit in Warrell’s observations, since the venom does present variations within populations, seasons, age of the animals (Gutiérrez et al., 1990), and that can also lead to wrong readings of ELISA tests. Coincidentally, Ripa in his latest work proposed the extension of the range distribution of *Lachesis muta rhombeata* to the entire forest south of the Amazon river, not just the Atlantic coast (Ripa, 2002).

Our position is clear: a snakebite in Brazil, or at least south of the Amazon river and in the Atlantic rainforest, without extreme and immediate local pain and edema and without early (20 minutes) gastrointestinal (diarrhea, vomiting) and cardiovascular (hypotension) repercussion, is not a *Lachesis* bite. There is no such thing as “walk for two days for help,” “deny local pain” or “refuse hospitalization” if you have been bitten by a *surucucu* (and had venom injected). In one accident in Serra Grande, Bahia, 21 January 2007, “N.R.” was knocked out by hypotension and could not make the 40-minute walk to town to get help, being saved by his wife who rushed for an ambulance right after killing the snake, extracting its tongue and forcing the husband to swallow it as an “antidote.”

Such “treatments” should be viewed as acts of despair due to the abandonment by the public health system (until very recently) of geographically isolated populations. However, we’ve also collected in the region ethnobotanic approaches, such as “graviola tea” (*Annona muricata*), which is now being

tested for possible anti-emetic and/or vasoactive properties.

In Serra Grande, we carry a kit of ampoules and syringes, ethylepinephrine cloridrate, adrenaline, atropine, metoclopramide for I.M. use and also saline solution for I.V. use; working in pairs (at least) is essential. In Case 1, “T.L.” was no longer capable of making a phone call within 15 minutes after the bite.

The field administration of antivenom must take into consideration the impossibility of quick rescue and the feasibility of controlling eventual reactions with limited resources. Alternating (12–20 vials of 10 ml ampoules) I.M. and I.V. administration to intentionally delay absorption for safety reasons (Pépin et al, 1995; Rivière et al., 1997) does not prevent the onset of complications such as major exanthema and bronchospasm, so it is wise to be ready for these medical emergencies. Allergy tests have been shown to be ineffective (Warrell, 1989). As soon as the patient makes it to the nearest hospital, signs and symptoms such as blood pressure drops, bleeding at the wound site, or the “triad” will reveal the need for more antivenom, “better late than sorry.” If no such signs are present and the patient can be considered hemodynamically stable with proper urinary debt, it is time to face other complications, edema being one of them.

Fasciotomies seem to have no indication in *Lachesis* bites. In Brazil, the concept of Compartment Syndrome (CS), an event of the first 24 hours, is still plagued with empiricism. Statistics from Vital Brazil Hospital (França and Cardoso, 1989; Pereira, 1989) show that CS was observed in only 1.4% of all *Bothrops* accidents, locally more aggressive than *Lachesis*. Precise indication could avoid further exfoliation, blood loss, risk of infection, longer hospitalization time, and expenses. The “usually disappointing” (Warrell, 1989) results of fasciotomies can be explained, at least in part, by the lack of reliable parameters upon which the decision has to be made (compartmental pressure above 45 mm Hg and doppler revealing obstruction to blood flow), and to the fact that muscle swelling and necrosis can be attributed to direct action of venom injected in the area.

The possibility of late blood pressure drops, bleeding to the digestive system and reaction to antivenom therapy demands in-hospital observation for 48–72 hours and ambulatory follow-up for the next 30 days. Infection in the wound site can turn into a major complication if deep fascial progression is undetected below normal looking skin. Common agents are: D group streptococcus, *Enterobacter* sp., *Providencia rettgeri*, *Providencia* sp., *Escherichia coli*, *Morganella morganii*, *Clostridium* sp., *Aeromonas hydrophila*, *Proteus mirabilis*, *Acinetobacter alcoaceticum*, *Pseudomonas aeruginosa* and *Klebsiella pneumoniae* (Bolaños et al., 1982; de Andrade et al., 1989; Jorge et al., 1990).

Close attention also must be paid to “serum disease” around the 20th day (sore joints, fever, dermatitis), mesenteric thrombosis (Rosenthal et al., 2002) and intracranial bleeding (Eric Jennings, pers. com.) that can be of early (first 24 hours) or late (fifth day) onset (see Figures 4 and 5).

It is important to remember that the dosages of antivenom



Figure 4. Intracranial bleeding 24 hours after a *Lachesis* bite, causing the death of a 23-year-old man. Accident near Santarém, Pará State, in 2003. (Courtesy Dr. Eric Jennings)

are the same in children as in adults, and that antithrombotic antivenom will not neutralize the coagulant factor of *Lachesis* venom, so its use is not recommended (Bard et al., 1994). Heparin has also no indication in *Lachesis* bites.

Conclusion

Lachesis bites should be considered medical emergencies, regardless of the size of the animal. In Brazil, they can happen anywhere in the Brazilian Atlantic rainforest remnants, from Rio de Janeiro State up to Rio Grande do Norte State, parts of Ceará State (Feitosa et al., 1997; Freitas and Silvia, 2005), possibly in “Parque do Rio Doce” or “Zona da Mata” in Minas Gerais State and in the Amazon region as a whole. The animal is highly dependent upon and adapted to unspoiled rainforest at medium altitude (high humidity and low temperatures).

From a medical standpoint, the academic discussion as to whether *Lachesis* should maintain its subspecific differentiation (Ripa, 2002) or should be considered as two populations of the same species (Fernandes et al., 2004) is irrelevant. The present edition of rules of the *International Code of Zoological Nomenclature* (Fourth Edition, ISBN 053301-006-4) maintains the trinomial status (subspecies), but it's true that the concept of subspecies in herpetology is highly questionable.

It is of great medical importance however, to keep in mind that the venoms of both populations (coastal and Amazonian) are similar (Otero et al., 1998) and the clinical features in intoxications should also be similar. However, important variations such as local effects and central nervous system activation have been described (Warrell, 2004). The venom of the Amazonian animal has greater hemorrhagic activity, whereas the venom of the Atlantic Rainforest animal has greater

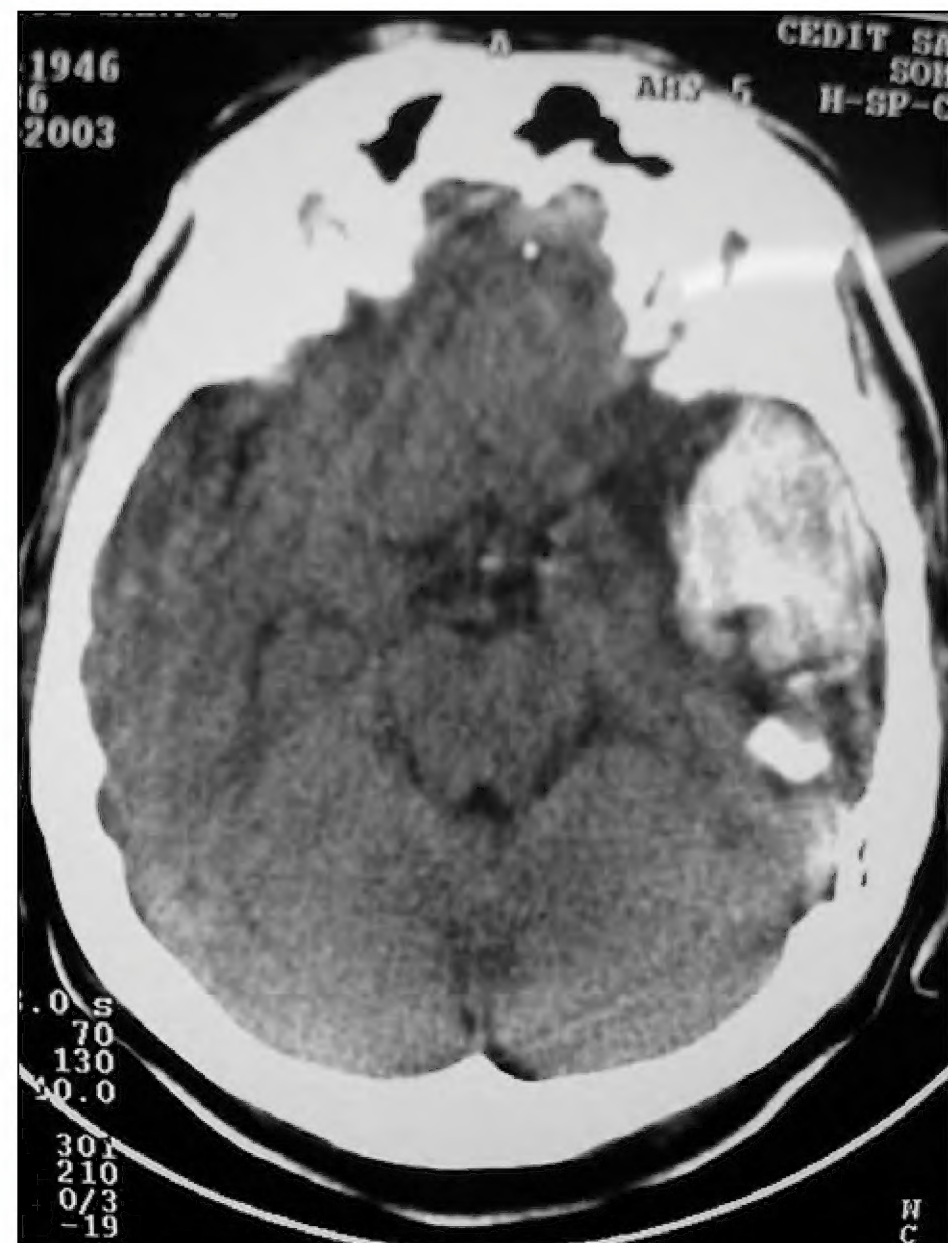


Figure 5. Intracranial bleeding in a 57-year-old man 5 days after a *Lachesis* bite; the patient survived neurosurgery. We do not know of any other cases where the patient survived intracranial bleeding in ophidism, worldwide. Great and historical job by Dr. Jennings, again near Santarém, Pará State in 2003. (Courtesy Dr. Eric Jennings)

coagulant activity (Otero et al., 1998). It is not clear at this point, how these differences fit in the puzzle of the “north margin” enigma.

Those who venture into *Lachesis* territory should recognize the risk, and work in pairs with a predetermined evacuation plan. In remote areas they should carry an emergency kit similar to the one used in Serra Grande, and know how to use it in to avoid early and severe hypotension and to allow oral intake of liquids or medication (blocking vomiting) while on the way to the nearest hospital.

Until a lyophilized version for human use reaches the Brazilian market, refrigeration at 3–8°C and respect to expiration dates insure antivenom effectiveness when needed. A well-planned distribution among major towns will help avoid the tragic costs of late treatment: death, suffering and monetary costs. In our series, efficient distribution meant eight lives saved without any permanent handicap. Expense considerations also lead us to affirm that tests such as ELISA are recommended but not necessary to differentiate *Lachesis* accidents from the others.

The statistical frequency of snakebite incidents in the Amazon region, 76% *Bothrops* and 17% *Lachesis* (Bard et al., 1994), indicates that the obvious antivenom to be distributed (and carried around) in these areas is the highly effective (Pardal et al., 2004) Bothropic-Lachetic Antivenom (BLA) but



Figure 6. Dark areas denote *Lachesis* Territory.

attending physicians in ERs in the darker areas of the map above should keep in mind that *Crotalus* is also present in the Amazon and in some coastal biomes of Atlantic Rainforest (“restingas”) in Piauí State (Freitas and Sylvia, 2005), and that *Micrurus* too (some without the red rings) share the well preserved forest with *Lachesis* and *Bothrops*.

Notification of snakebites is compulsory in Brazil, but most of our statistics remain unreliable due to undernotification, general ignorance about such accidents, and work overload in underequipped and understaffed ERs, all of which might contribute to poor planning in the distribution of BLA throughout the vast Brazilian territory. A good example of such unreliable statistics is an old review of medical records in the Ilhéus area that points to *Lachesis* bites as being about 0.5% of all venomous snakebites. *Lachesis* bites are uncommon due to the ecology of the animal and its usually calm disposition. Nevertheless, as noted by Bard et al. (1994) and in the present work, they are not so rare as 0.5%.

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Figure 7. Baby Atlantic *surucucu*, Núcleo Serra Grande, in Itacaré, Bahia State, Brazil (see de Souza, 2007).

While we watch in real time the burning down of the Amazon and the progressive destruction of the remaining 7% of the Atlantic Rainforest, signaling a dire future of *Lachesis* in the wild, isolated actions such as the Serra Grande breeding center try to compensate the damage already done via programs that may generate animals for antivenom production, reintroduction of animals to their native habitat and advanced pharmacological research.

Acknowledgments

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Book Reviews:

***Alternata* — *The Gray-banded Kingsnake* by Gerold Merker and Walter Merker
2005. 80 pp. LM Digital.**

and

***Zonata* — *The California Mountain Kingsnake* by Mitchell Mulks and Gerold Merker
2004. 64 pp. LM Digital.**

Gerry Salmon

PO Box 823

Millbrook, NY 12545

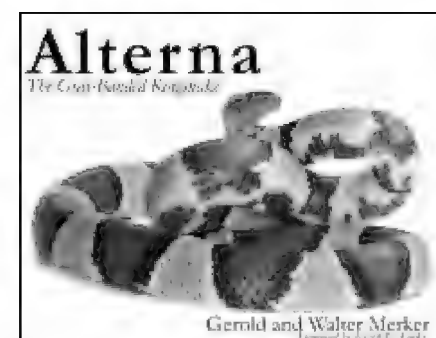
gtsalmon@optonline.net

It seems fitting that I was asked to write a review on two new kingsnake picture books. Many years' worth of nights spent herping throughout the Big Bend region of West Texas involved endless hours of road-cruising. The daytime hours were for rest, relaxation, herp camaraderie, and catching up with old friends and their stories of collecting and breeding successes. Getting together over long lunches, occasionally leading well into cocktail hour, led to the development of larger and larger photo albums depicting the hard-to-believe variety of colors and patterns of gray-banded kingsnakes. The California boys would often blow us away with spectacular pictures of the western mountain kingsnakes (often attempting to teach us the nuances of regional variation). I was the compiler of one of the largest photo albums on gray-bands, which created "oohs" and "aahs" from many seasoned field herpers. Albums such as this whet the appetite for picture books that would show regional variation in polymorphic species. These two new books include informative but brief text (the text seems almost dis-

tracting from the great photos) as a narrative "to take you there," especially off-season when the fever sets in.

The two books are *Alternata* — *The Gray-banded Kingsnake* by Gerold and Walter Merker, and *Zonata* — *The California Mountain Kingsnake* by Mitchell Mulks and Gerold Merker. The Merkers are veteran field workers with both species and are excellent photographers as well. The Merkers have authored and co-authored over 60 articles for such magazines as *The Vivarium*, *Reptiles*, *Reptile and Amphibian Hobbyist* and *Ecology*.

Alternata — *The Gray-banded Kingsnake* is an 80-page, low-cost paperback, filled with wonderful images of *Lampropeltis alternata* specimens (arranged by locality), habitat shots and numerous other Big Bend and



Trans-Pecos herps.

As is the deal with locality-specific *alterna*, some of the specimens depicted in this book are less than spectacular but are representative of snakes collected in the wild. It's been said that all *alterna* are interesting and beautiful though some are better than others (this has been said of beer as well). The rating system with the typical scale of 1–10 applied to gray-bands seems to start at 4 and average 7; there are few 10s. There are some in this book that approach the top. The photography itself is excellent and well presented. I was a little less impressed by the range maps and their accuracy, but they are accurate enough to give a rough idea where the specimens originate by general region. It may be a bit misleading in mapping populations in this way as many of the areas are not "islands" but are somewhat continuous, then with expanses of no specimens collected. These areas are yielding occasional DOR (dead on road) or live snakes, thus filling in the range. The maps may indicate more the accessibility of roadways that bring collectors into the habitats. The populations sampled would be more accurately shown as linear (just a little wider than the roads themselves). Still, the shaded areas are enough to give the reader a general idea of the region specified, and simple cross-referencing with a highway map will reveal rough collection points.

The associated snakes of the region (the nine counties of far West Texas) and relationships to some of the venomous snakes that gray-bands are said to mimic (Trans-Pecos copperheads and mottled rock rattlesnakes) are shown and briefly discussed. I was planning on commenting on the rough green snake photograph as it seemed rather extraneous looking in size and placement within the other species section. I had thought it'd be a stretch to find one in west Texas. Recently Damon Salceies happened to find one in a canyon south of Sanderson and a check with Werler and Dixon's *Texas Snakes* does show range in Terrell and Val Verde County. Other than those minor points the book is accurate and a pleasure to flip through. Until someone produces a hard-cover coffee-table edition with hundreds of shots (outside the scope of this project), this book will be the one to have and is currently the only one of its type. It is quite a bargain at \$19.95.

Joseph E. Forks wrote the foreword for the *Alterna* book and I cannot think of someone more qualified to do it. He has been a fixture in the Trans-Pecos since he was teenager. Joe is an excellent field observer, naturalist and photographer. He is an understated expert on many aspects of all that is West Texas and the Chihuahuan Desert. As Joe would say, "I live too close" (to *alterna* range). He does, and I am sure it is very hard to stay at home in San Antonio when the herps are moving only several hours to the west.

Zonata — The California Mountain Kingsnake by Mitchell Mulks, with photography by Gerold Merker and Luke Mulks, provides 64 pages of fantastic images and information on these visually striking serpents. I especially liked the information on habitat and the photographic collages of snout and triad variations. There is an interesting blown-up photograph of a *zonata*'s head with the scales labeled. The species accounts all differ in form and content, but they make for interesting reading. This book costs less than the gray-banded kingsnake book (fewer pages but not a noticeable issue) and is priced at \$15.95.



Barry Sinervo wrote the foreword for the *Zonata* book. He is a professor of ecology and evolutionary biology at the University of California, Santa Cruz, and an authority on the biology of lizards, amphibians and sea urchins.

LM Digital did a very good job in bringing both books through production and to the market at a low cost. The format works and is a welcome addition in the libraries of herpetologists and naturalists alike. I was recently pleasantly surprised to see a copy of the gray-banded kingsnake book in the local Barnes and Noble bookstore. It is nice to see good herp books distributed and readily available.

A beloved (and now missed) frequent attendee of the roundtable, long lunches down in the Big Bend, Ben Dial (noted herpetologist and professor at Chapman University) would have been especially interested to see both of these books being completed and available. I would have enjoyed hearing his enthusiastic commentary on them.

What You Missed at the June CHS Meeting

by John Archer
j-archer@sbcglobal.net

It had been a long time since I last attended a June meeting. For some reason, June seems to be a busy month for me, and I just haven't made them. I hope that it will be a long time before I miss another.

For those of you not familiar with the routine, June is the monthly meeting normally reserved for show-and-tell. That's right, just as in your elementary days, everyone brings in an animal, or multiples thereof, to talk about. And I mean everybody, from the very young to the very old (well, maybe not that old), and any kind of animal as long as it's a herp. Remember the excitement you felt as a youngster when you had a chance to show all the other kids the slick new toy that you had brought for that day's show-and-tell? Or how cool it was to be told about that really neat rock someone had found on summer vacation?

But maybe it was boring! Maybe you weren't interested in rocks, and couldn't wait for that other kid to quit talking about that stupid rock. Here's the secret behind June's show-and-tell: we're all interested in herps! It truly is a winning situation for all concerned; we get to talk about our animals and we get to listen to others talk about theirs. No talking about rocks.

As I walked into the June meeting I noticed a difference in the atmosphere—a little more chaotic, a little noisier, a little more energy. June draws more kids, and more adults, than most other meetings. Everyone seems to have an animal. There's anticipation in the air and everyone seems more animated when they've got animals to show. Jack Schoenfelder once again presented his version of Christmas in June. He brings toys and stuffed animals, makes sure that each kid in the room has a raffle ticket, and then makes sure that every kid wins. All the prizes are provided by Jack, and the kids love it. So the adults wouldn't be jealous, a regular monthly raffle was conducted by Josh Chernoff. Then the real fun began. I'm going to short change you. I can't repeat all the presentations, but I noticed some themes common to many of the talks.

Starting with escapes. I know of no herper who does not have an escape story. The animals we deal with are escape artists, and the inevitable result is that we frequently find our animals not in the locations we wish they were. So we have stories of corn snakes found by mom while doing laundry, ball pythons discovered by the carpet cleaners, and iguanas stuck in neighbors' trees. Those are the happy endings. The sad endings don't make it to show-and-tell.

Many of the animals shown had been acquired through the CHS adoption program, and stories abounded about hapless boa constrictors and skinny bearded dragons rescued from a truly inhumane existence and now looking fit and lively. Frequently one adopted animal preceded an entire collection of adopted animals, and adopting often exposed members to animals they had previously not thought of owning, much to their pleasure.

Some of the animals were uncommon, like the pair of woma pythons or the Taiwan beauty snake, or spectacular, such as the five-foot long alligator that was as tame as a dog, or the 15-foot reticulated python that was manhandled from its very large snake bag. But the stories behind the leopard geckos, the corn snakes, and the American toads managed to hold my attention as easily as the exotics. I enjoy listening to how fast a pixie frog is growing and how much an Argentine horned frog can eat.

And variety reigned. Let's be honest, snakes rule at the CHS, but nearly every kind of herp was represented at this meeting: an Indian star tortoise and a Gulf Coast box turtle, leopard geckos and bearded dragons, giant pythons and diminutive corn snakes, frogs and toads, and the only salamander, a lesser siren. A truly diverse group of animals representing the varied interests of our members. The presenters were diverse



Jack Schoenfelder's special kids' raffle. Photo by Dick Buchholz.



The regular monthly raffle. Photo by Dick Buchholz.



Joey Robinson led off the proceedings with his gray-banded kingsnake. Photo by John Archer



Matt Campbell, kilted as usual, showed us his Taiwan beauty. Photo by Dick Buchholz.



Molly Carlson brought Snoopy, a nice ball python. Molly's earrings were pretty neat too. Photo by Dick Buchholz.



Michelle Nielson with two bearded dragons, Lady and Spike. Photo by Dick Buchholz.



Dick Buchholz and his American alligator, Nessie, take center stage.



All who know Marybeth Trilling know she's really into frogs. Here she shows off her White's treefrog. Photo by Dick Buchholz.



After 30 years, Dave Smiskol has developed an obvious rapport with Rocky, his Gulf Coast box turtle.

also, from the very young to the pretty old, from owners of single animals to the breeders and folks with huge collections, from those who have been with the society from nearly its beginning to people who have just joined, from those who house their animals in aquariums to those who remodel bedrooms for iguanas.

The common thread among all the presenters, and probably everyone in the room, was how they perceived the animals. Being herpers certainly sets us apart from mainstream America, and the attraction of amphibians and reptiles is not easily understood by most people. They should come to this meeting. Every animal was an individual, and every animal was treated with respect. The stories told reflected the interaction between human and animal that is so hard to convey to anyone who has not felt it. We really like these critters, and we don't have to explain why to this audience. They already love them as we do.

Thanks to the speakers and their animals!

- Joey Robinson, winner of the best first time exhibitor award at ReptileFest 2007, with Cody, his corn snake (*Pantherophis guttata*), and Allie, the gray-banded kingsnake (*Lampropeltis alterna*).
- Gabrielle Schreiber with her corn snakes, Oppenhiemer and Einstein, which had surprised her with real live examples of snakes doing what snakes do in the spring.
- Elliot Schreiber with his hyperactive leopard gecko (*Eublepharis macularius*) named Cricket.
- Michelle Nielson with her Mom's bearded dragon (*Pogona vitticeps*), Lady, and Spike, Lady's adopted companion.
- Dane McKittrick with his fat "Pacman" frog (*Ceratophrys ornata*), Mr. Chubbs, which will soon eat pinkies rather than very large crickets.
- Matt Campbell with his long-tailed male Taiwanese stripe-tailed rat snake (*Elaphe taeniura*). The females lay huge eggs.
- Jason Hood and the woma pythons (*Aspidites ramsayi*) with which he occasionally shares his bed (sorry, Jason, I couldn't resist).
- Aaron LaForge with his short-tailed, slightly-less-than giant



Dan Nathan brought several of his green iguanas, each one looking healthier than the next.

gecko (*Rhacodactylus leachianus*) from New Caledonia.

- MaryBeth Trilling with her grinning White's treefrog (*Litoria caerulea*), fast growing pixie frog (*Pyxicephalus adspersus*), and cute local American toads (*Bufo americanus*).
- Jack Schoenfelder, who steals worms from robins to feed his lesser siren (*Siren intermedia*).
- Dick Buchholz, who spends way too much time with his alligator (*Alligator mississippiensis*), Nessie, and who won the peoples' choice award at ReptileFest.
- Dan Nathan with his gang of iguanas (*Iguana iguana*), including the stars Diesel and Mia, and a playground display for all of them that made the kids jealous. Dan won the exhibitors' choice award at ReptileFest.
- Simon Lothschutz and his mom Laura, with his surprise egg-laying recently adopted corn snake, Artemesia.
- Dave Smiskol with Rocky, his Gulf Coast box turtle (*Terrapene carolina major*) of 30 years, which was an adult when he acquired it.
- Mike Dloogatch with a gorgeous fox snake (*Pantherophis vulpina*), Shadow, a 1998 road rescued hatchling that he acquired from a former CHS sergeant-at-arms.
- Molly Carlson showed off her ball python (*Python regius*), Snoopy, and told of its liking for the innards of reclining chairs.
- Jim Foster with his "Faberge egg," a two-year-old Indian star tortoise (*Geochelone elegans*) he bought as a hatchling in preference to a *sulcata* when he learned just how large the latter can grow.
- Josh Chernoff with his shy, inquisitive, always-ready-to-return-home boa constrictor (*Boa constrictor*), "the Don."
- Bob and Dan Bavirsha demonstrating with their reticulated pythons (*Python reticulatus*), one small, one large called Lady, that even retics can be nice . . . and very large.

I apologize if I got a presenter's name or the animals' name wrong. The tape was not good and my ears are old. Feel free to email me and I'll publish a correction.

Next year I think I'll bring my bullsnake, or maybe my daughter's milksnake . . . if they don't escape before then.

Herpetology 2007

In this column the editorial staff presents short abstracts of herpetological articles we have found of interest. This is not an attempt to summarize all of the research papers being published; it is an attempt to increase the reader's awareness of what herpetologists have been doing and publishing. The editor assumes full responsibility for any errors or misleading statements.

LONGEST NATIVE U.S. SNAKE DOCUMENTED

T. Devitt et al. [2007, Herpetological Review 38(2):209-21] note that the eastern indigo snake (*Drymarchon corais couperi*) has been heralded as the longest native snake in the United States, having been documented to reach a total length (TL) of 2629 mm (103.5 in). In June 1999 one of the authors (Armin Meier) collected a bullsnake (*Pituophis catenifer*) near Loma Alta, Val Verde County, Texas. After being kept and fed in captivity for about 2 years, on 12 October 2001 this snake measured 2667 mm (105 in) TL. This specimen represents a new record for the longest native snake in the United States and extends the record length for the genus *Pituophis* by 127 mm (5 in). A photograph of Mr. Meier with the snake accompanies this natural history note.

A NEW TOAD SPECIES FROM PENINSULAR MALAYSIA

L. L. Grismer [2007, J. Herpetology 41(2):225-230] describes *Ingerophrynus gollum*, a new, lowland species of the *I. biporcatus* group from the Endau-Rompin National Park in southern, peninsular Malaysia, Johor. The specific epithet refers to Gollum, "a semi-aquatic, large-headed, gracile-limbed fictional creature with a rasping cough who was created by J. R. R. Tolkien in *The Hobbit*." The species is unique in various aspects of morphology and color and is the third, new herpetological species discovered and described from this region of the Malay Peninsula since 2005. This suggests that the biodiversity of this part of southern Malaysia may be significantly underestimated and underscores the importance of continued field research in these lowland forests, which are currently being logged and converted to oil palm plantations.

VARIATION IN FEMALE COLOMBIAN SLIDERS

J. M. Daza and V. P. Páez [2007, Herpetologica 63(2):125-134] evaluated morphometric variation and reproductive effort in *Trachemys callirostris callirostris* females from nine populations in the Mompos Depression of northern Colombia. Two hypotheses were evaluated: (1) phenotypes of nesting females co-vary according to geographic distances among sites and/or specific environmental conditions at each site; (2) female body size influences reproductive potential and offspring characteristics. Populations were shown to differ in both mean female body size and body shape, with differences more related to local habitat characteristics than to geographic distances among sites. Larger females occurred in sites with higher annual precipitation and lower hunting pressure. Female size was highly correlated with clutch size and mass. Although habitat characteristics affected female size, habitat alone was not a predictor of reproductive potential. Specific habitat conditions and hunting both influence female phenotypes in this region and thereby also influence key demographic parameters, which have clear conservation implications for this highly exploited species.

DISAPPEARANCE OF *ATELOPUS* SPECIES

M. Lampo et al. [2006, The Herpetological Journal 16(4):395-402] note that chytridiomycosis has been identified as one of the major forces driving global amphibian declines. Between 1988 and 1994, five *Atelopus* species endemic to the Venezuelan Andes disappeared. The authors examined histological samples of Andean *Atelopus* species available in Venezuelan museum collections for the presence of the chytrid fungus *Batrachochytrium dendrobatidis*. When infection was detected, sympatric species were examined to investigate the occurrence of the pathogen and how widespread it was. Infection with *B. dendrobatidis* is reported for the first time in *Atelopus carbonerensis*, *A. mucubajensis*, *A. sorianoi*, *Mannophryne cordilleriana* and an undescribed *Leptodactylus* species. The spatio-temporal patterns of prevalence of this pathogen in *Atelopus* individuals, with all infections concentrated in one year but spread over distant locations, suggest that synchronized epidemic outbreaks occurred in populations of these *Atelopus* species in the years prior to their disappearances. Local climate data indicate that one of the most severe dry seasons recorded in the region since 1970 coincided with these epidemic events. The climatic-linked epidemic hypothesis seems a plausible explanation for the coincidence between the observed amphibian declines, the chytridiomycosis outbreaks and the droughts recorded in that area.

NEWTS AND AQUATIC PLANT DIVERSITY

D. H. Gustafson et al. [2006, The Herpetological Journal 16(4):347-352] in a field study in south central Sweden, analyzed the diversity of macrophytes in paired samples of ponds in a total of five geographically separated sites. Each pair of ponds involved one pond with presence of great crested newts (*Triturus cristatus*) and one pond in which newts were absent. Ponds with presence of great crested newts had a significantly higher mean number of plant species than ponds without newts. Newts occurred in ponds that tended to have a lower amount of pond area covered by surface vegetation, although this difference was not statistically significant. Macrophyte diversity also tended to increase more steeply in ponds with *T. cristatus*, compared with ponds without newts. Broad-leaved pond weed (*Potamogeton natans*) and square-leaved liverwort (*Chiloscyphus pallescens*) were among the plants that were most associated with presence of great crested newts. Plant diversity had a slightly more nested structure for ponds with great crested newts than for those without, which indicates a more homogeneous plant species assemblage in the former group of ponds. Overall, the results indicate that the great crested newt may be a reliable and useful indicator species for high plant species richness in ponds and small wetlands, which may be valuable for environmental monitoring and conservation in pond landscapes.

TIMBER RATTLESNAKE A SINGLE WIDESPREAD SPECIES

J. Allsteadt et al. [2006, Herpetological Monographs 20:1-63] note that the timber rattlesnake (*Crotalus horridus*) occurs in discontinuous populations across the eastern and central United States. The species exhibits high levels of polymorphism in morphological traits, especially in coloration and pattern. Previous studies recognized either distinct northern and southern subspecies or three regional morphs (northern, southern, and western), but the conflicting data sets and limited geographic sampling of previous studies have left the relationships among those regional variants unclear. In this study, univariate and multivariate statistics, analyzed in conjunction with a geographic information system, were used to examine geographic variation in 36 morphological characters recorded from 2420 specimens of *C. horridus* across its range. Univariate analyses detected substantial geographic variation in all meristic characters. Scutellation exhibited a general north-south pattern of variation, and most scale counts averaged higher in southern regions. Pattern characters differentiated the northeastern, central-eastern, and north-central regions from the southern and western regions. Coloration displayed a pattern of strong clinal variation among three broad areas consisting of the combined northeastern, central-eastern, and southern Appalachian regions, the northwestern regions, and the southern regions. Morphometric characters exhibited a general north-south pattern of geographic variation, with larger head and body sizes in southern regions. Sexual dimorphism was strong in ventral and subcaudal scales, and weak to moderate in band length and band spacing. Principal component analysis indicated that band length was the most important variable for characterizing geographic variation. The northeastern regions remained moderately distinct in all multivariate cluster analyses. The northwestern regions appeared very distinct in most cluster analyses for females. However, the clusters in all models showed extensive geographic overlap. Maps of the clusters revealed two north-south patterns of clinal variation across the northeastern, northwestern, and southern regions. The discordant patterns of variation among individual characters, overlapping patterns of coloration, and extensive overlap among the multivariate clusters collectively indicate that the putative zones of intergradation among recognized subpopulations of *C. horridus* are much broader than previously thought. Furthermore, because the general patterns of geographic variation are strongly clinal, these results support the conclusion that *C. horridus* is a single widespread species with variation too extensive and complex to be reflected by formal subspecific designations.

RECOVERY CRITERIA FOR THE LAKE ERIE WATERSNAKE

R. B. King et al. [2006, Herpetological Monographs 20: 83-104] note that the Lake Erie watersnake, *Nerodia sipedon insularum*, occurs only in the island region of western Lake Erie, an area less than 40 km in diameter. Restricted geographic distribution and declining population size resulted in this snake's classification as Threatened in the U.S. and Endangered in Ontario and Ohio. A combination of mark-recapture

methods, capture rate information, and interpolation were used to estimate the current U.S. population size of Lake Erie watersnakes. A total of 121 point estimates were generated using both "closed" population (Lincoln-Petersen, Schumacher's) and "open" population (Jolly-Seber, Bailey's triple-catch) methods to analyze data collected from 1980 through 2004. Paired t-tests, comparing estimates obtained using alternative methods, were consistently non-significant. Although standard errors and confidence intervals of individual estimates were often large, standard errors of mean estimates, obtained by averaging across methods and sets of consecutive years, were markedly smaller, averaging 14% (range = 5-25%). These analyses demonstrate the utility of mark-recapture methods even in cases where sample size and recapture rates are low, as may often be true for threatened and endangered species. Another 60 estimates were obtained by applying the Lincoln-Petersen method to samples collected in consecutive years. As expected if recruitment occurs between samples, these estimates were significantly larger than those obtained using other methods. By comparing these recruitment-biased estimates to unbiased estimates, annual adult recruitment (and by extension, adult survivorship) was estimated to be 0.63. At 11 study sites for which recent (2000-2004) mark-recapture estimates were available, population density (adults/km) was highly correlated with capture rate. The regression relationship between density and capture rate was thus used to estimate watersnake population size at 19 additional sites for which only capture rate was known. Interpolations of watersnake population size were made at another 29 sites, thus encompassing the entire U.S. range of the Lake Erie watersnake. Interpolations were based on habitat suitability, land-use practices, the observed presence of watersnakes, and density at sites for which mark-recapture or capture rate estimates were available. Lake Erie watersnake densities exceeded those of many other snakes. At 30 sites for which recent estimates were available, median density = 141 adults/km of shoreline (range = 11-1107 adults/km). Mark-recapture estimates encompassing 15.8 km and capture rate estimates encompassing 19.6 km of shoreline on the U.S. islands totaled more than 6500 adult watersnakes. Including interpolated numbers at 28.3 km of uncensused shoreline to encompass the entire U.S. distribution of the Lake Erie watersnake brought this total to nearly 7700 adults. This exceeds 5555 adults, the number specified in the *Population Persistence* criterion of the Lake Erie Watersnake Recovery Plan. Estimates also exceeded island-specific criteria for Kelleys, South Bass, and Middle Bass Island. On North Bass Island, estimated population size (385 adults) fell short of the island-specific recovery criterion (410 adults) unless interpolated numbers at uncensused sites were included (total = 443 adults). Other criteria for delisting the Lake Erie watersnake include *Habitat Protection and Management* and *Reduction of Human-induced Mortality*. Recent land acquisitions, development of watersnake-friendly land management plans, and outreach efforts seeking to foster public appreciation and minimize watersnake-human conflicts have contributed to achievement of these goals. These actions, together with this snake's capacity for rapid population growth, make recovery and eventual delisting of the Lake Erie watersnake a real possibility.

Unofficial Minutes of the CHS Board Meeting, June 15, 2007

Vice-president Steve Sullivan called the meeting to order at 7:30 P.M. Board members Kira Geselowitz, Deb Krohn, Linda and Andy Malawy, and Jenny Vollman were absent.

Officers' Reports

Recording Secretary: Steve Sullivan read the minutes of the May 18 board meeting that had been taken by Kira Geselowitz. With minor corrections the minutes were accepted.

Treasurer: Mike Dloogatch presented the treasurer's report in Andy Malawy's absence.

Membership Secretary: Mike Dloogatch reported membership has increased slightly from mid-2006 levels.

Vice President: The December 26 meeting will be a holiday party, looking at possibly extending the evening for members to get to know each other and socialize. Meeting may start at 6:30 P.M. ZooMed contacted in regards to possibly wishing to donate to organization with items for the raffle.

Corresponding Secretary: Cindy Rampacek reported receiving a lot of nuisance calls in regards to wild snappers. She encouraged people to allow the animals to go through their normal laying season movements unmolested. Calls came into CHS number from both IL and WI. Cindy also reported a gentleman was attempting to contact CHS board members regarding a 7-foot aggressive Burmese python needing relocation. This animal has been sent into a rescue.

Publications Secretary: Erik Williams reported that our CHS Forums are active. They can be accessed from our website www.chicagoherp.org. Steve Sullivan has some suggestions on *Bulletin* printing and mailing to help save costs. He attended a recent seminar on topic and he will share the information with Mike Dloogatch.

Sergeant-at-arms: Jason Hood reported attendance for the May general meeting was 54.

Committee Reports

Shows:

- Reptile and All Animal Show in Wheaton—June 17, July 8, August 5 & 18
- Lake County Reptile Show in Grayslake second weekend of each month—need coverage for August 11, website is www.lakecountyreptileshow.com. Cindy Rampacek will staff this event.
- Argonne National Laboratory Employee Picnic is July 14. Jenny Vollman, Bob Bavirsha, Rich Crowley and Mike Scott will staff this event.
- Peggy Notebaert Nature Museum—shows likely first weekend. Contract is still pending.
- Oak Park Library Harry Potter event is July 20—Rich Crowley, Specter and Jenny Vollman will staff.
- Morton Grove, July 28, 1 - 4 P.M. —volunteers needed.
- Illinois State Fair, August 13-14—volunteers wanted.
- Milwaukee Public Museum Snake Days, November 10—any questions on snake days contact Cindy Rampacek.

- Members night at Musuem of Science and Industry is July 5 same night as our General Meeting.

- Chicago Wilderness "Leave No Child Inside" program dates forthcoming.

Anyone interested in staffing shows contact Jenny Vollman with your availability.

Raffle: Raffle went well; the ZooMed products were very popular. Thanks go out to ZooMed for their donations.

Library: Steve Sullivan's office flooded, but the library survived without damage. Flood attributed to drains and human error. Steve will attempt to move library cart to prevent any future damage.

Adoptions: Rich Crowley received a call from a construction site to collect an 18-inch prairie rattlesnake that came in with flagstone transported from Colorado. The snake has been transferred to the Lake Forest Wildlife Discovery Center. If healthy will be on display. Rich has photos.

Conservation: Blue Iguana looking for volunteers to work on Grand Cayman. If interested visit www.ircf.org

ReptileFest: Next year's 'Fest will be held April 12-13, 2008.

Old Business

Wildlife Discovery Center visit: It was a very successful trip and a good time was had by all.

Kentucky trip: September 15-16. Visiting Louisville Zoo, Kentucky Reptile Zoo, and field herping in the area. Members need to provide their own transportation and lodging. Entrance to Louisville Zoo is \$10 per person. Carpooling may be available. If interested in more details contact Jason Hood.

The Field Museum's Darwin Exhibit is open, and the CHS assisted in supplying animals.

New Business

Amazon.com: Discussion as to keeping our relationship with them in light of sales of animal-fighting-related items. Letter will be sent to Amazon expressing displeasure in continued sales of such items.

Ideas and Suggestions / Round Table

- Dick Buchholz started a discussion on improving display tables. Discussion was very energetic and some suggestions were , games for CHS Fundraising, newsletters/bulletin free handouts, if available, laptops with photo slides available. Many on the board have photos available for these displays.
- Newsletter for shows—Cindy Rampacek is looking for photos from meetings. Cindy will be putting together a one page "About Us" newsletter for CHS shows.
- Jason Hood suggests everyone visit our new CHS Forums. Chris Lechowicz has done some really extensive work on the forums to make them more friendly for users. Stop by today. Sign up through our CHS website: www.chicagoherp.org

- Josh Chernoff read a *Sun-Times* article about turtle soup. A restaurant in the Chicagoland area is serving 50 gallons a day, more than likely made of snappers. Photo attached in article is not the species served. Possibly gopher or desert tortoise.
- Jason commented on a bill in Texas regarding road cruising becoming illegal. The original bill got killed and new bill approved with different wording. At the last minute a rider added to the bill to ban cruising. This bill is now passing.

Turtle harvesting has been made legal in Texas now. For more information on this legislation, visit www.kingsnake.com where they have been heavily involved in covering this bill. Reminds us to watch what our legislators are doing in regards to our keeping practices.

The meeting was adjourned at 9:12 P.M.

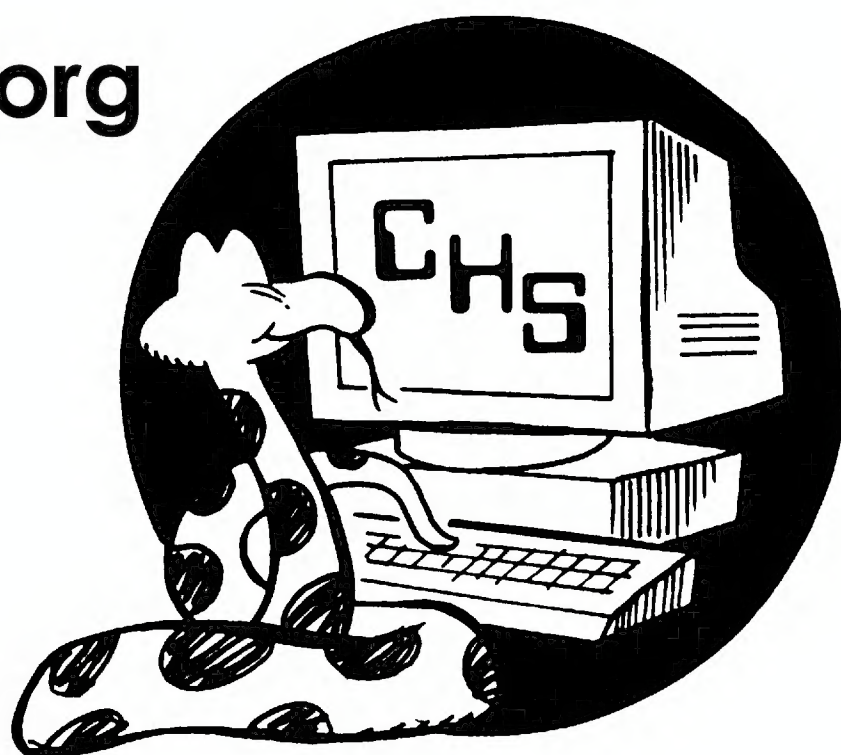
Respectfully submitted by Cindy Rampacek

Next time you surf the WorldWide Web, crawl, run, slither, slide, jump, or hop over to the CHS web site!

www.chicagoherp.org

You'll find:

- Announcements
- CHS animal adoption service
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- Photos of Illinois amphibians & reptiles
- Much, much more!



Chicagoherp.org is accepting applications for banner advertisements or links from herpetoculturists and manufacturers of herp-related products. Visit the site and contact the webmaster for details on how you can sponsor CHS!

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For sale: rats and mice—pinkies, fuzzies and adults. Quantity discounts. Please send a SASE for pricelist or call Bill Brant, *THE GOURMET RODENT*, 6115 SW 137th Avenue, Archer FL 32618, (352) 495-9024, E-mail: GrmtRodent@aol.com.

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For sale: Graptemys.com T-shirts, 100% cotton, pre-shrunk, pigment-dyed shirts with the Graptemys.com embroidered logo. These are very high quality shirts with that stylish faded look. Sizes S-M-L-XL-XXL. Colors: Pacific blue, nautical red, brick red, plum, granite, khaki green and putty. All profits made from these shirts goes directly to in situ *Graptemys* research. \$20 each with \$3.00 shipping. Email: chris@graptemys.com or call (239) 437-4148 to order. You can look at the shirts at <http://www.graptemys.com/shirts.htm>

For sale: books. *The British Amphibians and Reptiles* by Malcolm Smith, 1973, 322 pp., 16 b&w plates, 16 color plates, 91 figs., DJ, hardbound—a detailed natural history by this noted herpetologist—\$20; *Records of the American-Australian Scientific Expedition to Arnhem Land - Vol. 4 - Zoology* edited by R. L. Specht, 533 pp., many b&w and color plates, DJ spine split, otherwise excellent cond., scientific work of the 1948 Arnhem Land expedition, covers mollusks, fishes, reptiles and amphibians (35 pp., 2 plates, 7 figs.), birds and mammals, hardbound, \$95; *Birds of Pine-Oak Woodland in Southern Arizona and Adjacent Mexico* by Joe T. Marshall, Jr., 1957, 125 pp., 26 figs., 2 color plates, contains descriptions of habitats of this herpetologically-rich area, hardbound, \$30; *Boy's Book of Snakes* by Percy Morris, 1948, 185 pp., many b&w photos, contains elementary husbandry information, some minor ink marks on introductory page, otherwise excellent cond., \$10. All books in excellent condition except as noted. \$2.50 postage and handling for orders under \$25, free for orders \$25 and over. William R. Turner, 7395 S. Downing Circle W., Centennial CO 80122; phone (303) 795-5128; e-mail: toursbyturner@aol.com.

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Virtual Museum of Natural History at www.curator.org: Free quality information on animals—emphasis on herps—plus expedition reports, book reviews and links to solid information. Always open, always free.

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UPCOMING MEETINGS

The next meeting of the Chicago Herpetological Society will be held at 7:30 P.M., Wednesday, July 25, at the Peggy Notebaert Nature Museum, Cannon Drive and Fullerton Parkway, in Chicago. **Jim Harrison**, director of the Kentucky Reptile Zoo, will speak on “The Evolution of Venom Extraction.” Jim has been studying venom for over 30 years and currently extracts from more than 600 animals per week.

At the August 29 meeting, **Dr. Douglas Mader**, of Marathon, Florida, will speak on “Medical Marvels in Herp Medicine.” You may be familiar with Dr. Mader through his monthly column in *Reptiles* magazine, “Veterinarian Q&A.” And if you’ve ever taken a herp to the vet, you’ve likely benefited from his book, *Reptile Medicine and Surgery*, which is the standard veterinary textbook on the subject.

The regular monthly meetings of the Chicago Herpetological Society take place at Chicago’s newest museum — the **Peggy Notebaert Nature Museum**. This beautiful new building is at Fullerton Parkway and Cannon Drive, directly across Fullerton from the Lincoln Park Zoo. Meetings are held the last Wednesday of each month, from 7:30 P.M. through 9:30 P.M. Parking is free on Cannon Drive. A plethora of CTA buses stop nearby.

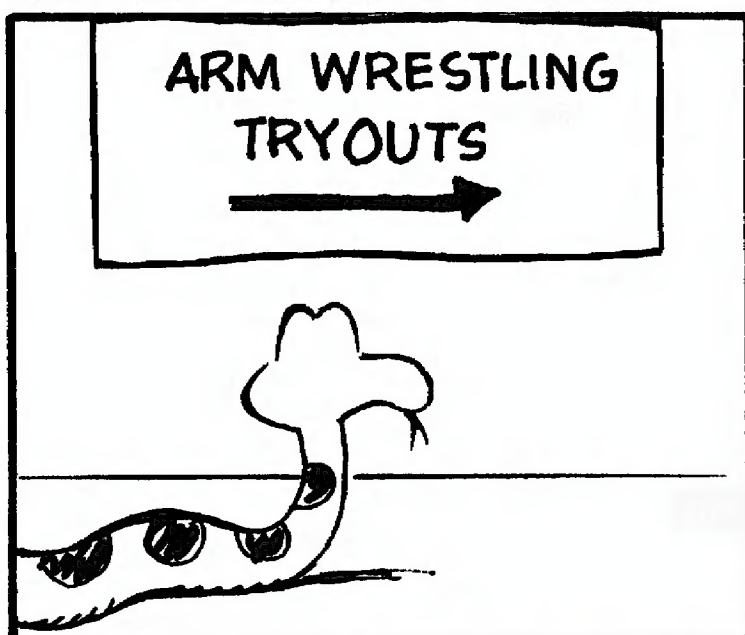
Board of Directors Meeting

Are you interested in how the decisions are made that determine how the Chicago Herpetological Society runs? And would you like to have input into those decisions? If so, mark your calendar for the next board meeting, to be held August 17. For information as to where the meeting will be held and directions, call Mike Dloogatch at (773) 588-0728.

The Chicago Turtle Club

The monthly meetings of the Chicago Turtle Club are informal; questions, children and animals are welcome. Meetings normally take place at the North Park Village Nature Center, 5801 N. Pulaski, in Chicago. Parking is free. For more info visit the CTC website: <http://www.geocities.com/~chicagoturtle>.

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